Ollscoil na hÉireann, Gaillimh
National University of Ireland, Galway

Autumn Examinations, 2010/2011

Exam Code(s)	4IF
Exam(s)	4th Year Examination in BSc in IT
Module Code(s)	CT421
Module(s)	Artificial Intelligence
Repeat Paper	
External Examiner(s)	Professor M. O'Boyle
Internal Examiner(s)	Dr J. Duggan Professor G. Lyons Dr Conn Mulvihill Dr. F. S. Smith

Instructions: Attempt 2 questions from section A and two questions from section B

Duration **3 hours**

No. of Pages 4
Department(s) Information Technology

Section A

1)

a) Write the following Prolog predicates:
min(X,Y,Z).
which is true if Z is the minimum of X and Y.

Explain how your predicate would respond to the following query:
:-min(Num,9,7).
(6 marks)

i) inlist(Num,List). Which is true if the value Num is a member of the list List.

How would your predicate respond to the following query?

inlist([x],[1,2,3,[x]]).
(7 marks)

b) Explain what is meant by the "Closed World Assumption" in Prolog, pay particular attention to its advantages and disadvantages.
(7 marks)

2)

a) Explain the terms forward and backward chaining. Give an example of when the use of each of them would be appropriate.
(5 marks)

b) Describe each of the following. Highlighting their advantages and disadvantages:
i) Depth first search
ii) Breadth first search
iii) Bounded depth first search
iv) Depth first search with iterative deepening
v) Heuristic search
(15 marks)

3)

a) Explain what is meant by Qualitative Reasoning. What are its advantages and disadvantages.
(3 marks)

b) Give an example of an application where Qualitative Reasoning would be suitable. Justify your answer.
(3 marks)

c) Give an example of an application where Qualitative Reasoning would not be suitable. Justify your answer.
(3 marks)

d) Given the following constraints (which represent the motion of a ball being thrown in the air):

DERIV(x , v)
DERIV(v , a)
a = g < 0

and the quantity spaces:
{ -∞, 0, ∞} for v
{ 0, top } for x

If the initial state is:
$QS(x,t_1)$=<top,std>
$QS(v,t_1)$=<0,dec>
$QS(a,t_1)$=<g,std>

What are the possible next states? (Show your workings)

Rule-id	$QS(v,t_i)$	$QS(v,t_i,t_{i+1})$
P1	$<l_i$,std>	$<l_i$,std>
P2	$<l_i$,std>	$<(l_i,l_{i+1})$,inc>
P3	$<l_i$,std>	$<(l_{i-1},l_i)$,dec>
P4	$<l_i$,inc>	$<(l_i,l_{i+1})$,inc>
P5	$<(l_i,l_{i+1})$,inc>	$<(l_i,l_{i+1})$,inc>
P6	$<l_i$,dec>	$<(l_{i-1},l_i)$,dec>
P7	$<(l_i,l_{i+1})$,dec>	$<(l_i,l_{i+1})$,dec>

(7 marks)

e) What discrete states would the ball pass through after being thrown up into the air?
(4 marks)

Section B

4) (a) In the context of genetic algorithms, what do you understand by the term fitness function?
(6 marks)
(b) Explain what is meant by roulette wheel selection (6 marks)
(c) Sketch the development of a simple genetic algorithm to find a way out of a two-dimensional maze, explaining carefully what fitness measure you are using (8 marks)

5) (a) What do you understand by the term finite state machine? (6 marks)
(b) Explain what is meant by child state competes in state transitions
(6 marks)
(c) Sketch the development of finite state machines for both an attacking and a defending player in any field sport of your choosing (8 marks)

6) (a) Explain what is meant by an Eliza-like system (6 marks)
(b) Give your understanding of the term context-free grammar (6 marks)
(c) Develop a simple grammar for accepting strings of the form:
empty, ab, aabb, aaabbb and so on. (8 marks)